

Appendix B.

Ecoregions of the State



The department manages 2.1 million acres of forested state trust lands; 1.4 million acres in Western Washington and .7 million acres in Eastern Washington. As the above map reflects, there are nine ecoregions that make up Washington State: Northwest Coast; Puget Trough; North Cascades; West Cascades; East Cascades; Okanogan; Canadian Rocky Mountains; Blue Mountains; and Columbia Plateau. Each of these ecoregions are further described in this appendix.

Washington Ecoregion	DNR Surface Ownership	DNR Forested Acres
Blue Mountains	20,140	4,852
Canadian Rocky Mountains	104,992	98,068
Columbia Plateau	595,111	18,117
East Cascades	293,959	227,110
North Cascades	346,494	321,104
Northwest Coast	641,554	625,435
Okanogan	442,191	327,698
Puget Trough	213,342	201,987
West Cascades	333,198	321,018
TOTAL	2,990,981	2,145,389

DISTURBANCES

Major disturbance events, both natural and human-caused, have defined the current condition of Western Washington forested state trust lands. Windstorms, which create chaotic patterns of broken and windthrown trees, have shaped Washington forests through the centuries. Examples of notable historic windstorms are the 1921 storm on the western Olympic Peninsula and the Columbus Day storm of 1962, which blew down thousands of acres of mature timber in Western Washington. Major ice storms, such as the 1955 freeze, have also changed the structure of forests all over Western Washington. Today, numerous forest stands containing trees with crooked boles and forked tops serve as reminders of the millions of treetops killed by this freeze. Fire, both natural and human-caused, has historically been one of the great shapers of forest composition in both Eastern and Western Washington. As an example, parts of the 94,055-acre Yacolt Burn State Forest in southwestern Washington burned several times between 1902 and 1952. Today, this area is forested with young Douglas-fir trees and a few old remnant trees in riparian areas and ravines.

While a century of fire control has played a key role in creating the current forestland conditions in Western Washington, timber harvest is probably the greatest human influence. Almost all forested state trust lands have been logged at least once in the last 100 years. Much land in Western Washington was clearcut and logged from 1900 to 1940. Some of the harvested land was abandoned and then acquired later by the state as State Forest Transfer Lands or State Forest Purchase Lands. Remnants of logging railroads and abandoned truck roads are scattered on state lands and bear witness to the intensity of logging in Western Washington in the first half of the 20th century and earlier. Fire scars on residual trees and charred old-forest stumps show the effects of frequent fires that followed the first logging in those early years. Large parts of these forests naturally reseeded themselves from trees that survived the fires and from the hardwoods and other species in unburned riparian areas. After the fires, alder flourished in some landscapes that were once dominated by old conifers. The presence of large conifer stumps in many alder stands shows this vegetation change.

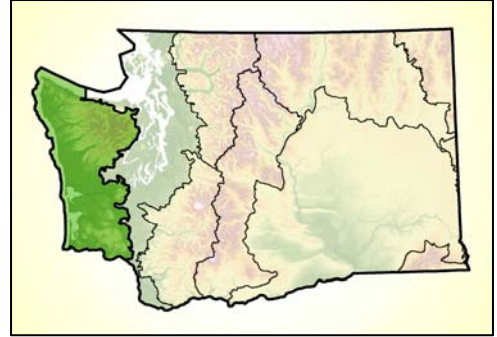
Historically, stand-replacement fires occurred at irregular intervals from ten years in the lowlands to 150 years or more at high elevations. The control of forest fire this century has played a key role in defining the existing conditions. Fire has been minimized in many areas that formerly burned naturally at fairly regular intervals. In many places, this has significantly changed the species in and around structural composition of forests. For example, frequent low-intensity fires once maintained large areas of ponderosa pine. The thick bark of the pine protected it from significant damage while less fire-tolerant trees were killed. By nearly eliminating fire from these areas, species such as grand fir developed dense understories that have excluded pine regeneration. These new stands are more structurally diverse, but their multi-layered canopies are more susceptible to catastrophic fires. These dense stands of relatively low value timber are also susceptible to insects and disease.

NORTHWEST COAST ECOREGION

The Northwest Coast ecoregion includes most of the Olympic Peninsula of Washington, the coast mountain ranges extending down to central Oregon, and most of Vancouver Island in British Columbia. Approximately 11 percent of Washington is within this ecoregion.

Approximately 5 percent of the ecoregion is agriculture and urban environments with most cities located near Grays Harbor and Willapa Bay. There are 641,554 acres of department-

managed lands within the Northwest Coast Ecoregion, of which 625,435 are forested.



PHYSIOGRAPHY

The Olympic Mountains, the ocean coast and coastal plain, and the Willapa Hills are the ecoregion's dominant landforms. Glaciated peaks in the Olympic Mountains rise to an elevation of nearly 8,000 feet above sea level. Streams and rivers typically begin as deeply incised, steep-gradient drainages that eventually feed large, low-gradient river systems on the coastal plain. The coastal plain is up to 20 miles wide on the Olympic Peninsula and mostly underlain by glacial till and outwash. Major estuaries and associated dunes are found on the southern coast. The Willapa Hills are well-rounded highlands with old, well-weathered soils.

CLIMATE

High precipitation typifies the ecoregion, averaging 60 to 240 inches annually. Most precipitation falls as rain from November through April. Snow pack and rain-on-snow zones cover a considerable area only in the Olympic Mountains. As a result of a rain shadow effect, the northeastern side of the Olympic Mountains receives the lowest precipitation of equivalent elevations anywhere in Western Washington. Along the outer coast and adjacent valleys, fog and cool temperatures in the summer are important climatic factors.

BIOTA

Coniferous forests dominate the vegetation of the ecoregion. Typical lowland forests are dominated by western hemlock, Douglas-fir and western red cedar. In the coastal fog belt, Douglas-fir is rare and Sitka spruce becomes abundant. Forests in the mountains are mostly dominated by Pacific silver fir and mountain or western hemlock. High elevations in the Olympic Mountains have sub-alpine parkland and alpine habitats.

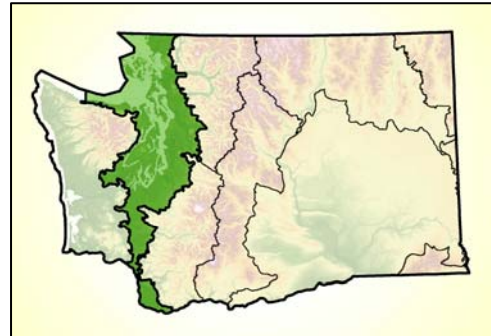
Two of the largest estuaries on North America's west coast are part of this ecoregion. Other special habitats include coastal dunes, wetlands, riparian areas and sphagnum bogs. The Olympic Mountains are rich in rare plant species due to their isolation, the number of unusual habitats and the presence of steep environmental gradients. They include both those endemic to the Olympic Mountains and those disjunct from other mountainous areas.

Amphibian diversity is relatively high within this ecoregion. Vascular plant endemism is high, particularly in the northeast corner of the ecoregion.

Since the 1960s, the department has used a sustainable harvest approach in managing forested state trust lands. Designated areas are harvested and regenerated each year. Most early regeneration efforts concentrated on establishing Douglas-fir in recently harvested or deforested areas. Today, a mix of harvest practices and a variety of tree species are typically prescribed to match site-specific management prescriptions with the environmental characteristics of a site.

PUGET TROUGH ECOREGION

The Puget Trough ecoregion is nestled between the Cascade and Olympic Mountains and the Willapa Hills. It includes Puget Sound and the lowlands south to the Columbia River. The ecoregion extends north into the Georgia Basin in British Columbia and south into the Willamette Valley in Oregon. Roughly 8 percent of Washington is within this ecoregion. The state's most densely populated ecoregion with over 50 percent of its area supporting urban environments and agriculture. There are 213,342 acres of department-managed lands within the Puget Trough ecoregion, of which 201,987 are forested.



PHYSIOGRAPHY

The Puget Trough ecoregion includes the marine waters of Puget Sound and the lowlands generally up to about 1,000 feet above sea level. A few isolated highlands within the ecoregion extend up to 2,400 feet in elevation. Pleistocene glaciers left glacial till plains over much of the area north of Olympia and outwash plains between Tacoma and Centralia. Ancient, well-weathered soils predominate between Centralia and Clark County. Pleistocene flood events formed the smooth floor of the Portland Basin in the vicinity of Vancouver. In the far north, the San Juan Islands and mainland hills are composed of rocks common in the adjacent mountainous ecoregions. Large, low-gradient rivers typically begin in the adjacent mountains and flow through this ecoregion. Many small streams originate at low elevations. Freshwater lakes are numerous in the glaciated portions of the ecoregion.

CLIMATE

Much of the Washington portion of the ecoregion is influenced by the rain shadow effect of the Olympic Mountains and Willapa Hills. Precipitation, primarily rain, averages 20 to 70 inches per year. Summers are warm and dry compared to elsewhere in Western Washington and winters are relatively mild.

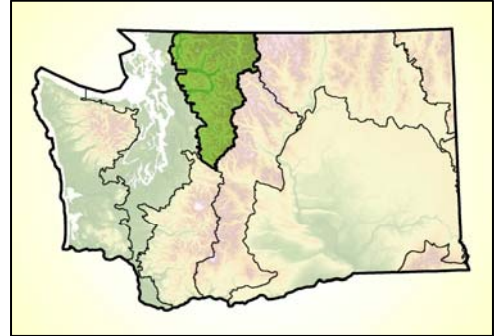
BIOTA

The vegetation of the Puget Trough is dominated by Douglas-fir forests with western hemlock and red cedar as the primary late-successional species. Oregon white oak,

Pacific madrone, big leaf maple, and red alder forests are frequent components of the landscape. Grassland habitats are often associated with oak habitats and support a number of rare species, including the federally threatened golden paintbrush and a number of butterfly species. Historically, frequent fires maintained these grasslands and the adjacent open oak woodlands. Many rare grassland species are declining as this landscape becomes more urbanized and fire suppression leads to more densely forested areas. Other special habitats within the ecoregion include wetlands, riparian areas, bogs and estuaries.

NORTH CASCADES ECOREGION

The North Cascades ecoregion includes the Cascade Mountains north of Snoqualmie Pass and west of the crest extending northward into British Columbia. Approximately 10 percent of Washington occurs within this ecoregion. Less than 2 percent of the ecoregion is agriculture and urban environments concentrated in lowland valleys near the Puget Trough. There are 346,494 acres of department-managed lands within the North Cascades ecoregion, of which 321,104 are forested.



PHYSIOGRAPHY

The North Cascades is composed of highly dissected, glaciated mountain terrain, mostly between 1,000 and 7,000 feet above sea level. The highest peaks are volcanoes that rise to over 10,000 feet. Valley bottoms extend down to as low as 500 feet. Glacially carved U-shaped valleys and cirques are prominent features. Watersheds typically begin as steep-gradient small stream drainages that feed major rivers leading into the adjacent Puget Trough ecoregion. Natural lakes, most of which were created by glacial processes, are plentiful.

CLIMATE

High precipitation typifies the ecoregion, varying from around 60 to 160" per year. Most precipitation accumulates from October through April as snow and rain. High elevations in the mountains are covered with snow for many months. Middle elevations have significant snow packs that fluctuate over the course of the winter with rain-on-snow events. Lower elevations within the ecoregion accumulate little snow or have transient snow packs.

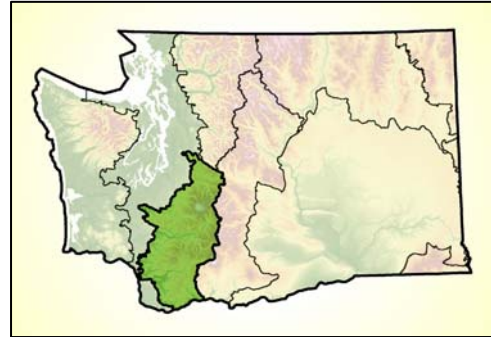
BIOTA

The vegetation of the North Cascades ecoregion in Washington consists mostly of western hemlock-Douglas-fir-western red cedar forests at low elevations, Pacific silver fir-western hemlock forests at middle elevations, and a mosaic of mountain hemlock-silver fir forests and sub-alpine parkland at high elevations. Natural stand-replacement fires occur at irregular intervals of 90 to 250 years. Above the timberline, alpine heaths, meadows and fellfields are interspersed with barren rock, ice and snow. Special habitats include riparian areas dominated by broadleaf trees, avalanche chutes dominated by Sitka

alder or vine maple and wetlands. Rare plant species in this ecoregion are often circumboreal species on the southern edge of their range, with populations scattered in the high Cascades. This ecoregion is one of the few in Washington with a variety of large carnivores, including gray wolf, grizzly bear and wolverine. Salmon are found in most of the large rivers.

WEST CASCADES ECOREGION

The West Cascades ecoregion extends west from the Cascade crest from Snoqualmie Pass southward to the Oregon-California border. Approximately 8 percent of Washington is within this ecoregion. Around 8 percent of the ecoregion is agriculture and urban environments located in lowland valleys near the Puget Trough and the Columbia River Gorge. There are 333,197 acres of department-managed lands within the West Cascades Ecoregion, of which 321,018 are forested.



PHYSIOGRAPHY

The West Cascades ecoregion consists mostly of highlands modified by montane glaciers and associated riverine valleys. The typical elevation range is 1,000 to 7,000 feet above sea level, with the highest peaks rising to over 14,000 feet on Mount Rainier and the lowest elevations in the Columbia River Gorge at 50 feet. Isolated volcanic peaks and associated high plateaus rise above surrounding steep mountain ridges. These mountains were formed primarily from extrusive volcanic rocks. Small, steep-gradient streams typically feed major rivers. Natural lakes are frequent and typically were created by glacial processes and landslides.

CLIMATE

The climate of this ecoregion is wet and relatively mild. Average annual precipitation ranges from about 55 to 140 inches. Most precipitation accumulates from October through April as snow and rain. High elevations in the mountains are continuously covered with snow for months. Middle elevations have significant snow pack that fluctuates over the course of the winter with rain-on-snow events. The lowest elevations accumulate little snow and generally have a transient snow pack.

BIOTA

Conifer forests dominate the vegetation of the West Cascades ecoregion. Douglas-fir-western hemlock forests are typical at low elevations. Middle elevations characteristically have Pacific silver fir, western hemlock, Douglas-fir and noble fir. High elevations have mountain hemlock-silver fir forests and sub-alpine parklands. Higher elevations on volcanic peaks support alpine heath, meadows, and fellfields among glaciers and rock. Special habitats include riparian areas dominated by broadleaf species, wetlands, grassy balds and oak woodlands. Mount Rainier supports a few endemic rare plant species, as does the Columbia River Gorge. Both are areas of high plant diversity. The Columbia

River Gorge has added biogeographic significance because of the mixing of coastal and interior floras.

EAST CASCADES ECOREGION

The East Cascades ecoregion lies east of the Pacific Crest, from Sawtooth Ridge near Lake Chelan south to the Oregon-California border. Its eastern border follows the montane forest-lowland shrub-steppe transition.

Approximately 10 percent of Washington is included within this ecoregion. Around 10 percent of the ecoregion is agriculture and urban environments located in lowland valleys along major transportation corridors and the

Columbia River Gorge. There are 293,959 acres of department-managed land within the East Cascades ecoregion, 227,110 of which are forested.



PHYSIOGRAPHY

The Eastern Cascades of Washington were modified by alpine glaciers and landslides which created rugged ridges extending southeast to east from the Cascade crest. Broad valleys occupy the lowlands between the mountain ridges. Isolated volcanic cones appear on the steep mountain ridges, but do not rise to the heights of volcanoes in the Western Cascades. A varied geology occurs in the east Cascades, including large serpentine areas in the Wenatchee Mountains. The typical elevation range is between 2,000 and 7,000 feet with the highest peak, Mt. Adams (12,276 feet) on the Pacific Crest and the lowest elevation in the Columbia River Gorge (100 feet). The Eastern Cascade ecoregion extends eastward to include the Wenatchee and Simcoe mountains.

CLIMATE

The climatic changes rapidly west to east, from cold with high precipitation (120 inches) along the Cascade crest to hot and dry with less than 20 inches per year along the foothills. Most precipitation accumulates from November through April. A snow pack develops at higher elevations.

BIOTA

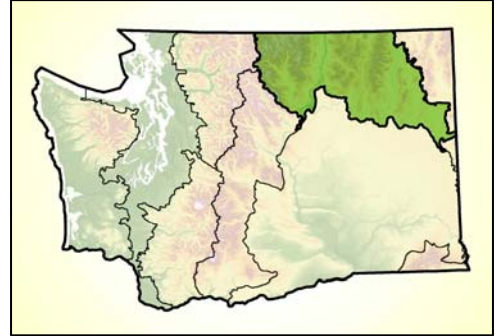
Conifer forests dominate the East Cascades ecoregion, although they are usually more open and patchy than forests of ecoregions west of the Cascade crest. Grand fir-Douglas-fir-Ponderosa pine forests are characteristic types. Oregon white oak woodlands appear at lower elevations and sub-alpine fir-mountain hemlock-Engelmann spruce types are typical at higher elevations. Douglas-fir-western hemlock-Pacific silver fir forests are present and locally can be abundant near low divides of the Cascades. Whitebark pine, lodgepole pine and western larch are common components of these forests.

Shrub-steppe vegetation occurs along the foothills and higher south-facing slopes and is often represented by big sagebrush or antelope bitterbrush with native bunchgrasses.

Alpine and sub-alpine parklands occur on the highest ridges and, more commonly, north of Snoqualmie Pass.

OKANOGAN ECOREGION

The Washington portion of the Okanogan ecoregion extends from the Cascade crest in the North Cascades east to the Selkirk Mountains. The ecoregion extends up the east slope of the Cascades into Canada and along the west slope of the Canadian Rockies to Kamloops, British Columbia. The southwestern border of the ecoregion follows Sawtooth Ridge northeast of Lake Chelan. The Methow and Okanogan valleys are included, as are the Okanogan Highlands east to the Colville and Spokane valleys. Approximately 14 percent of Washington is within this ecoregion. Around 15 percent of the ecoregion is agriculture and urban environments located in the Spokane, Colville and Okanogan valleys. There are 213,342 acres of department-managed lands within the Okanogan Ecoregion, 327,698 of which are forested.



PHYSIOGRAPHY

The Okanogan ecoregion is less distinct in terms of major landforms than other Washington ecoregions. It is more transitional, much of it having characteristics of adjacent areas. The northeast Cascades are the highest and most rugged part of the ecoregion, with peaks rising to over 9,400 feet.

The high mountains give way to a series of valleys with the lowest elevations around 750 feet. To the east, the mountains are more rounded. The Kettle Range and Huckleberry Mountains are prominent features. Continental and alpine glaciers played a major role in shaping the landforms of this ecoregion.

CLIMATE

Overall, this ecoregion has the coldest climate in the state. The western part of the ecoregion is in the rain shadow of the Cascade Mountains, while the eastern part is in a zone of increasing precipitation created by the Rocky Mountains. The ecoregion is influenced by the extremes of hot, dry air from the Columbia Basin in the summer and cold, dense arctic air in the winter. Annual precipitation is variable, from less than 12 inches in the Okanogan Valley to 50 to 90 inches in the Cascades. Most of the ecoregion falls within a 14 to 24 inches zone. There are fairly steep temperature and precipitation gradients from the mountains to the valleys within this ecoregion.

BIOTA

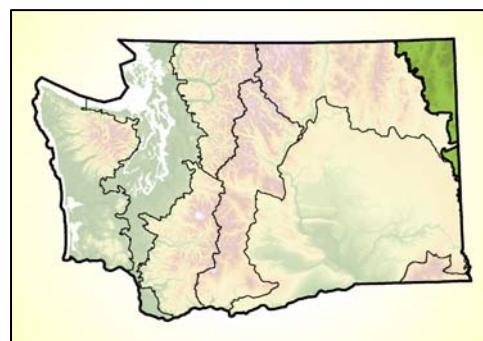
Conifer forests dominate the mountain ridges and low hills in the ecoregion, while valleys and lowlands are often non-forested. The conifer forests are more open and less continuous, consisting of smaller stands, than forests west of the Cascade crest and in the Canadian Rockies. Douglas-fir-ponderosa pine form the ecoregion's characteristic

forests. They transition to shrub-steppe in the low broad valleys in the eastern part of the ecoregion, and to grasslands in the western part. Sub-alpine fir-Engelmann spruce forests occur at higher elevations. Whitebark pine, lodgepole pine and sub-alpine larch form parklands in the highest elevations, often associated with dry alpine or sub-alpine meadows. The moister forests are dominated by Douglas-fir, with western larch, western white pine or quaking aspen as common components.

This ecoregion has a relatively high number of plant species that are rare in Washington, but more common to the north. This is particularly the case near Chopaka Mountain and in the Kettle Range. A few animal species from this ecoregion are also of particular conservation concern, including lynx, bull trout and grizzly bear.

CANADIAN ROCKY MOUNTAINS ECOREGION

The Canadian Rocky Mountains ecoregion is located in the northeastern corner of Washington. The vast majority of this ecoregion occurs in adjacent British Columbia and Idaho, extending into Alberta and Montana. Approximately 4 percent of Washington is within this ecoregion. No more than 10 percent of the ecoregion is agriculture and urban environments located in major lowland valleys. There are 104,992 acres of department-managed lands within the Canadian Rocky Mountains ecoregion, of which 98,068 are forested.



PHYSIOGRAPHY

The Selkirk Mountains and the north-flowing Pend Oreille River are the dominant landforms of this ecoregion in Washington. The Selkirk Mountains are transitional between the rolling Okanogan Highlands to the west and the higher ridges and mountains interspersed with wide valleys to the east. The Washington portion of the ecoregion was completely glaciated and now displays ice-carved, U-shaped valleys and isolated ice-sculpted mountain peaks. Elevations range from 1,300 feet along the Columbia River to greater than 7,000 feet in the Salmo-Priest Wilderness Area.

CLIMATE

Annual precipitation ranges from less than 18 inches along the Columbia River south of Northport to around 80 inches in the Salmo-Priest Wilderness Area. Most of the ecoregion falls within a 24 to 34 inches precipitation zone. Significant snow pack develops at mid and upper elevations.

BIOTA

Coniferous forests dominate this ecoregion. The composition of the forests reflects variation in moisture, temperature and elevation. Douglas-fir-ponderosa pine forests occur at low elevations; grand fir-western hemlock-western red cedar forests are characteristic of mid-montane elevations; and sub-alpine fir-Engelmann spruce forests

are found at higher elevations. Whitebark pine, lodgepole pine, and sub-alpine larch form parklands in the highest elevations. Western larch and western white pine can be major components of the moister forests.

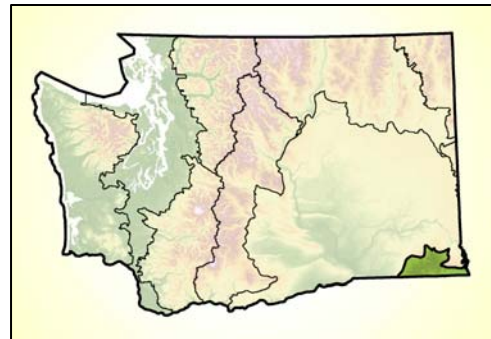
Fire has played a significant role in the development of the forests in this ecoregion, with a 10-year return interval in the lowland foothills and a 150-year return interval at high elevations and in protected canyons. The control of forest fire this century has played a key role in defining the existing conditions. Fire has been minimized in many areas that formerly burned naturally at fairly regular intervals. In many places this has significantly changed the species in and around structural composition of forests. For example, frequent low-intensity fires once maintained large areas of ponderosa pine. The thick bark of the pine protected it from significant damage while less fire-tolerant trees were killed. By nearly eliminating fire from these areas, species such as grand fir developed dense understories that have excluded pine regeneration. These new stands are more structurally diverse, but their multi-layered canopies are more susceptible to catastrophic fires. These dense stands of relatively low value timber are also susceptible to insects and disease.

Grasslands occur along the foothills and on higher elevation, south-facing slopes. These grasslands are variously dominated by green fescue, Idaho fescue or rough fescue.

The ecoregion has a number of plant species that are rare in Washington, but more common in the Rocky Mountains. The ecoregion, including the Washington portion, is home to moose, mountain caribou and grizzly bear.

BLUE MOUNTAINS ECOREGION

The Blue Mountains - Middle Rockies ecoregion extends from adjacent Idaho and Oregon into the southeast corner of Washington. It includes the Grande Ronde and Snake River canyons northward to a few miles south of Clarkston. Approximately 1 percent of Washington is within this ecoregion. Less than 1 percent of the ecoregion is agriculture and urban environments with no incorporated city limits in its Washington boundary. There are 20,140 acres of department-managed lands within the Blue Mountains ecoregion, of which 4,852 are forested.



PHYSIOGRAPHY

Columbia River Basalt flows were uplifted to form the Blue Mountains, which were simultaneously down-cut by the Grande Ronde and Snake Rivers. Today, flat top plateaus above deep canyons are characteristic of Washington's Blue Mountains. The typical elevation range is between 2,000 and 4,000 feet, with the highest peak at 6,387 feet and the lowest elevation at 750 feet along the Snake River. Windblown silts and volcanic ash cover most of the plateaus, providing material for soil development.

CLIMATE

Annual precipitation ranges from less than 10 inches in the canyon of the Grande Ronde River to more than 50 inches twenty-five miles to the west in the Wenaha-Tucannon Wilderness Area. Most of the ecoregion is within a 14 to 24 inches precipitation zone. Much of the precipitation appears as snow, although fall and spring rains are common, often creating flood events.

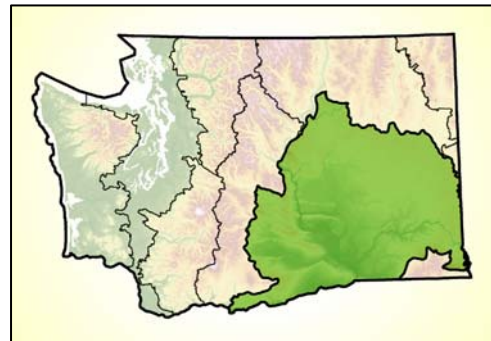
BIOTA

The Blue Mountains ecoregion is dominated by coniferous forest, but because of its characteristic abrupt topography and wide elevation ranges, it also supports grasslands and shrublands along low dry canyons, on broad plateaus and in sub-alpine meadows. Douglas-fir-ponderosa pine forests are characteristic of the low and middle elevations, with sub-alpine fir-Engelmann spruce types occurring at higher elevations. Western larch, lodgepole pine, and western white pine are components of mesic forests. Canyon grassland vegetation occurs on the steep slopes above the Grande Ronde and Snake Rivers. Plateau grasslands appear within the forest matrix. Dense shrublands occur in the higher canyons along the Oregon border.

Historically, stand-replacement fires occurred at irregular intervals from ten years in the lowland foothills to 150 years or more at high elevations. The control of forest fire this century has played a key role in defining the existing conditions. Fire has been minimized in many areas that formerly burned naturally at fairly regular intervals. In many places this has significantly changed the species in and around structural composition of forests. For example, frequent low-intensity fires once maintained large areas of ponderosa pine. The thick bark of the pine protected it from significant damage while less fire-tolerant trees were killed. By nearly eliminating fire from these areas, species such as grand fir developed dense understories that have excluded pine regeneration. These new stands are more structurally diverse, but their multi-layered canopies are more susceptible to catastrophic fires. These dense stands of relatively low value timber are also susceptible to insects and disease.

COLUMBIA PLATEAU ECOREGION

The Columbia Plateau ecoregion includes the area in Eastern Washington bounded by the Cascade, Okanogan, Blue and Rocky Mountains. It extends south in eastern Oregon to the Nevada border and then east to the Snake River Plain in Idaho. Approximately one-third of Washington is in this ecoregion. Over 50 percent of the ecoregion is primarily agriculture with scattered urban environments. There are 595,111 acres of department-managed lands within the Columbia Plateau ecoregion, of which 18,117 are forested.



PHYSIOGRAPHY

The primary, nearly exclusive, bedrock of this ecoregion is Columbia River basalt. Windblown silts and volcanic ash cover extensive areas, having created rolling, deep, productive soils. Ice-age floods carved deep canyons and coulees through the basalt. The floods also scoured some areas of soils and vegetation, leaving the basalt exposed on the surface. The ecoregion's dominant landforms include the Palouse Hills, the Channeled Scablands, the Yakima Fold Hills and the Pasco Basin. Elevations range from 160 feet above sea level along the Columbia River in the southwestern corner to nearly 4,000 feet above sea level on isolated hills (Badger and Tekoa mountains).

CLIMATE

This is the hottest and driest ecoregion in the state. It lies in the rain shadow of the Cascade Mountains. Annual precipitation generally increases west to east from around 6 inches per year along the Hanford Reach of the Columbia River to 25 inches in the Palouse Hills. Most of the ecoregion receives 8 to 14 inches of precipitation. The control of forest fire this century has played a key role in defining the existing conditions. Fire has been minimized in many areas that formerly burned naturally at fairly regular intervals. In many places this has significantly changed the species in and around structural composition of forests. For example, frequent low-intensity fires once maintained large areas of ponderosa pine. The thick bark of the pine protected it from significant damage while less fire-tolerant trees were killed. By nearly eliminating fire from these areas, species such as grand fir developed dense understories that have excluded pine regeneration. These new stands are more structurally diverse, but their multi-layered canopies are more susceptible to catastrophic fires. These dense stands of relatively low value timber are also susceptible to insects and disease.

BIOTA

The ecoregion is most often characterized as shrub-steppe dominated by various species of sagebrush and bunchgrasses. Most of the ecoregion's remaining native vegetation occurs on steep canyon sides and on the shallower soils of basalt scablands. Bitterbrush and three-tip sagebrush steppe appear along the foothills of the Cascades. Douglas-fir-ponderosa pine forests occur on the moister sites near the foothills of the surrounding mountains. Special habitats include sand dunes, gravelly areas, basalt cliffs, steep canyons, alkali lakes and vernal pools.

Many grassland and shrub-steppe species in this ecoregion are declining. Isolation and fragmentation of intact habitat is a primary factor. Non-native, weedy plant species are also a factor; they are a persistent and increasing feature of the limited semi-natural and natural landscape.